

2023 Resource Report

Town of Hardwick Electric Department

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Submitted to:

the Vermont Public Utility Commission
and the Vermont Department of Public Service

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Submitted by:

Vermont Public Power Supply Authority
on behalf of the Town of Hardwick Electric Department
in fulfillment of Vermont Public Utility Commission Rule 5.206(B)



Overview & Introduction

As a member of the Vermont Public Power Supply Authority (VPPSA), the Town of Hardwick Electric Department (“HED”) relies on VPPSA to plan for and manage its power supply in New England’s wholesale markets. In this role, VPPSA not only manages Hardwick’s power supply in the ISO New England’s (ISO-NE) wholesale power markets, but also plans for and solicits new power supplies for Hardwick and its other municipal utility members.

The information contained in this report describes Hardwick’s power supply needs and acquisition strategy over the next five years. It is divided into four sections.

I. Electricity Demand

This section shows how electricity demand has changed over the past five years, and forecasts the demand for the upcoming five years.

II. Electricity Supply

This section describes each resource in HED’s portfolio of supplies, as well as the new resources that have been acquired over the past year.

III. Electricity Supply & Demand

This section illustrates the balance between the supply and demand for energy, capacity, and renewable energy credits.

IV. Anticipated Transactions & Acquisition Strategy

This section lists the resources that are expected to be acquired over the upcoming five-year period, and outlines the strategy for procuring them.

I. Electricity Demand

In 2023, Hardwick's energy requirements¹ ("Load") totaled 39,867,148 kWh, and its coincident annual peak with ISO-NE was 6,242 kW on September 7th at hour ending 18. As shown in Table 1, Hardwick's energy requirements have fluctuated by about +/- 2.5% per year while its peak load² has fluctuated by up to 30%. This peak fluctuation is partly due to Hardwick's run-of-river, behind-the-meter hydro resource as well as the behind-the-meter solar project, which are not always operating at its capacity during the coincident peak hour.

Table 1: Historical Loads

| Year | Load (kWh) | % Change | Peak Load (kW) | % Change |
|------|------------|----------|----------------|----------|
| 2019 | 37,447,477 | -0.9% | 4,646 | 4.8% |
| 2020 | 37,608,137 | 0.4% | 6,071 | 30.7% |
| 2021 | 38,424,086 | 2.2% | 4,910 | -19.1% |
| 2022 | 38,889,237 | 1.2% | 4,958 | 1% |
| 2023 | 39,867,148 | 2.5% | 6,242 | 25.9% |

Hardwick's peak and energy needs are forecasted annually using a multiple regression model whose inputs include historical loads, weather, and economic variables like employment and income. These forecasts are adjusted for anticipated changes in net metering, heat pump and electric vehicle penetrations. Table 2 shows the results of the most recent 5-year load forecast.

Table 2: Forecast Loads

| Year | Load (kWh) | % Change | Peak Load (kW) | % Change |
|------|------------|----------|----------------|----------|
| 2024 | 40,341,291 | | 6,305 | |
| 2025 | 41,240,752 | 2.2% | 6,368 | 1% |
| 2026 | 41,900,604 | 1.6% | 6,431 | 1% |
| 2027 | 42,571,014 | 1.6% | 6,496 | 1% |
| 2028 | 43,252,150 | 1.6% | 6,561 | 1% |

Assuming normal weather, loads (kWh) are forecast to remain relatively flat, while peak loads are expected to grow by one percent per year.

¹Hardwick's energy requirements ("Load") include behind-the-meter hydro and solar generation (where applicable), transmission losses, and adjustments for Vermont's Standard Offer Program. Also known as "Total Load - Including Losses, it is not the same as Hardwick's Real-Time Load Obligation (RTLO) with ISO New England.

² Peak Load is defined as the annual coincident peak with ISO New England and is based on RTLO.

II. Electricity Supply

Hardwick's power supply is made up of owned generation, long-term contracts, and short-term contracts. The resources in Hardwick's portfolio represent a range of fuel types and technologies. In addition, they are located throughout Vermont, New England and New York and many of their expiration dates have been chosen not to overlap. As a result, they act as a diversified portfolio that effectively hedges Hardwick's power supply costs against the cost of serving load in ISO New England's energy, capacity and ancillary markets. These power supply resources are summarized in Table 3.

Table 3: 2023 Electricity Supply Resources

| Resource | 2023 MWH | % | Fuel | Exp. Date |
|----------------------------|---------------|---------------|--------------|--------------|
| Billings Road Solar | 2,165 | 5.9% | Solar | 11/3/46 |
| Brookfield 2023-2027 | 8,760 | 23.9% | Hydro | 12/31/23 |
| Chester Solar | 881 | 2.4% | System | 6/30/39 |
| Fitchburg Landfill | 3,403 | 9.3% | Landfill Gas | 12/31/31 |
| Market Contracts | 6,527 | 17.8% | System | Varies |
| McNeil Facility | 2,724 | 7.4% | Wood | Life of Unit |
| NYPA Niagara Contract | 3,915 | 10.7% | Hydro | 9/1/25 |
| NYPA St. Lawrence Contract | 141 | 0.4% | Hydro | 4/30/32 |
| Project #10 | 88 | 0.2% | Oil | Life of Unit |
| Ryegate Facility | 1,123 | 3.1% | Wood | 10/31/21 |
| Standard Offer Program | 860 | 2.3% | Solar | Varies |
| Stetson Wind 2023-2027 | 3,377 | 9.2% | Wind | 12/31/23 |
| Stony Brook Station | 88 | 0.2% | Oil | Life of Unit |
| Wolcott Hydro | 2,623 | 7.2% | Hydro | Life of Unit |
| TOTAL RESOURCES | 36,673 | 100.0% | | |

| | | | | |
|----------------------------------|--------|------|--|--|
| Total Load Including Losses | 39,867 | | | |
| ISO Exchange (+ Purchase/- Sale) | 3,194 | 8.7% | | |

Resource Descriptions

The following bullets summarize the essential characteristics of each resource, and in some cases, include notes that describe unique aspects of the resource.

1. Billings Road Solar

- Size: 1.6 MW
- Fuel: Solar
- Location: Hardwick, VT
- Entitlement: 100%, PPA
- Products: Energy, RECs (VTI, VT II)
- End Date: 11/03/46

2. Brookfield Hydro 2023-2027

- Size: 8 MW On Peak, 7 MW Off Peak
- Fuel: Hydro
- Location: Varies
- Entitlement: 1 MW On Peak, 1 MW Off Peak
- Products: Energy, VT Tier I RECs
- End Date: 12/31/27

3. Chester Solar

- Size: 4.8 MW
- Fuel: Solar
- Location: Chester, MA
- Entitlement: 15.1% (0.725 MW), PPA
- Products: Energy, capacity
- End Date: 6/30/39
- Notes: The contract does not include the environmental attributes.

4. Fitchburg Landfill

- Size: 4.5 MW
- Fuel: Landfill Gas
- Location: Westminster, MA
- Entitlement: 11.25% (0.506 MW), PPA
- Products: Energy, capacity, renewable energy credits (MA I)
- End Date: 12/31/31

5. Market Contracts

- Size: Varies
- Fuel: New England System Mix
- Location: New England
- Entitlement: Varies (PPA)
- Products: Energy, renewable energy credits
- End Date: Varies, less than 5 years.

- Notes: In addition to the above resources, the Electric Department purchases system power from various other entities under short-term (5 year or less) agreements. These contracts are described as Planned and Market Purchases in the tables below.

6. McNeil

- Size: 54 MW
- Fuel: Wood
- Location: Burlington, Vermont
- Entitlement: 1.474% (0.796 MW), joint-owned through VPPSA
- Products: Energy, capacity, renewable energy credits (CT Class I)
- End Date: Life of Unit
- Notes: As the joint-owner, VPPSA has agreements with the Electric Department to pay for and purchase 1.474% of the unit's output.

7. New York Power Authority (NYPA)

- Size: 2,675 MW (Niagara), 1,957 MW (St. Lawrence)
- Fuel: Hydro
- Location: New York State
- Entitlement: 0.4926 MW (Niagara PPA), 0.0324 MW (St. Lawrence PPA)
- Products: Energy, capacity, VT Tier I RECs
- End Date: 4/30/32
- Notes: NYPA provides hydro power to the Electric Department under two contracts, which will be extended at the end of their term.

8. Project 10

- Size: 40 MW
- Fuel: Oil
- Location: Swanton, VT
- Entitlement: 9.7% (3.88 MW) MW, joint-owned through VPPSA
- Products: Energy, capacity, reserves
- End Date: Life of unit
- Notes: As the joint-owner, VPPSA has agreements with the Electric Department pay for and purchase 9.7% of the unit's output.

9. PUC Rule 4.300 (Standard Offer Program)

- Size: Small renewables, primarily solar < 2.2 MW
- Fuel: Mostly solar, but also some wind, biogas and micro-hydro
- Location: Vermont
- Entitlement: 0.7184% (Statutory)
- Products: Energy, capacity, renewable energy credits
- End Date: Varies
- Notes: HED is required to purchase power from small power producers through the Vermont Standard Offer Program in 2023, in accordance with PUC Rule #4.300. The entitlement percentage

fluctuates slightly each year with the Electric Department's pro rata share of Vermont's retail energy sales.

10. Ryegate

- Size: 20.5 MW
- Fuel: Wood
- Location: East Ryegate, VT
- Entitlement: 0.7% (PPA)
- Products: Energy, capacity, renewable energy credits (CT Class I)
- End Date: 10/31/2032

11. Stetson Wind 2023-2027

- Size: 57 MW
- Fuel: Wind
- Location: Maine
- Entitlement: 3.19% (PPA)
- Products: Energy, VT Tier I RECs
- End Date: 12/31/2027

12. Stony Brook Station

- Size: 352 MW
- Fuel: Natural Gas, Oil
- Location: Ludlow, MA
- Entitlement: 0.528% (PPA)
- Products: Energy, capacity, reserves
- End Date: Life of unit

13. Wolcott Hydro

- Size: 0.815 MW
- Fuel: Hydro
- Location: Wolcott, VT
- Entitlement: 100%, Owned
- Products: Energy, capacity, environmental attributes (VT I)
- End Date: Life of Unit

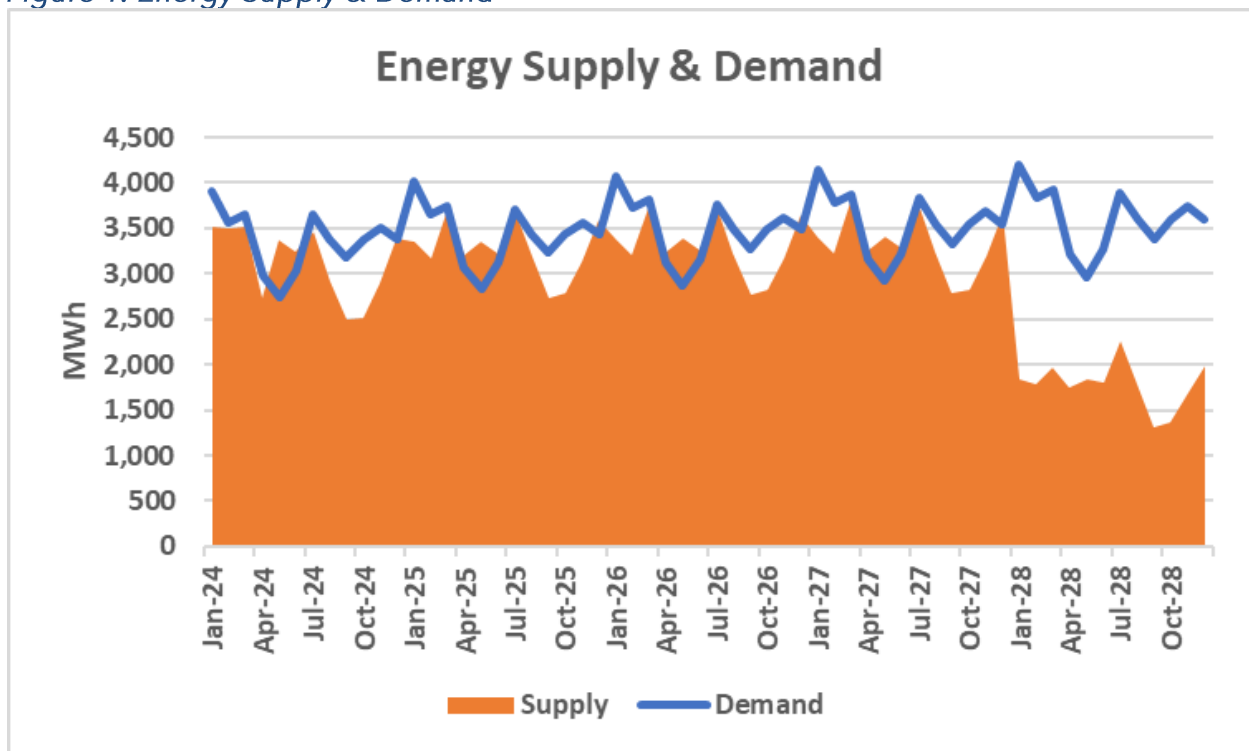
III. Resource Supply & Demand

Energy, capacity and Renewable Energy Credits (RECs) are the primary products that HED needs to manage, and the following sections illustrate the forecasted balance between their supply and their demand over the next five to twenty years.

Energy

Figure 1 shows the current forecast of energy supply and demand for the next five years. The annual coverage ratio is on the low side for VPPSA members for the next few years but falls off considerably when Brookfield and Stetson contracts expire at the end of 2027.

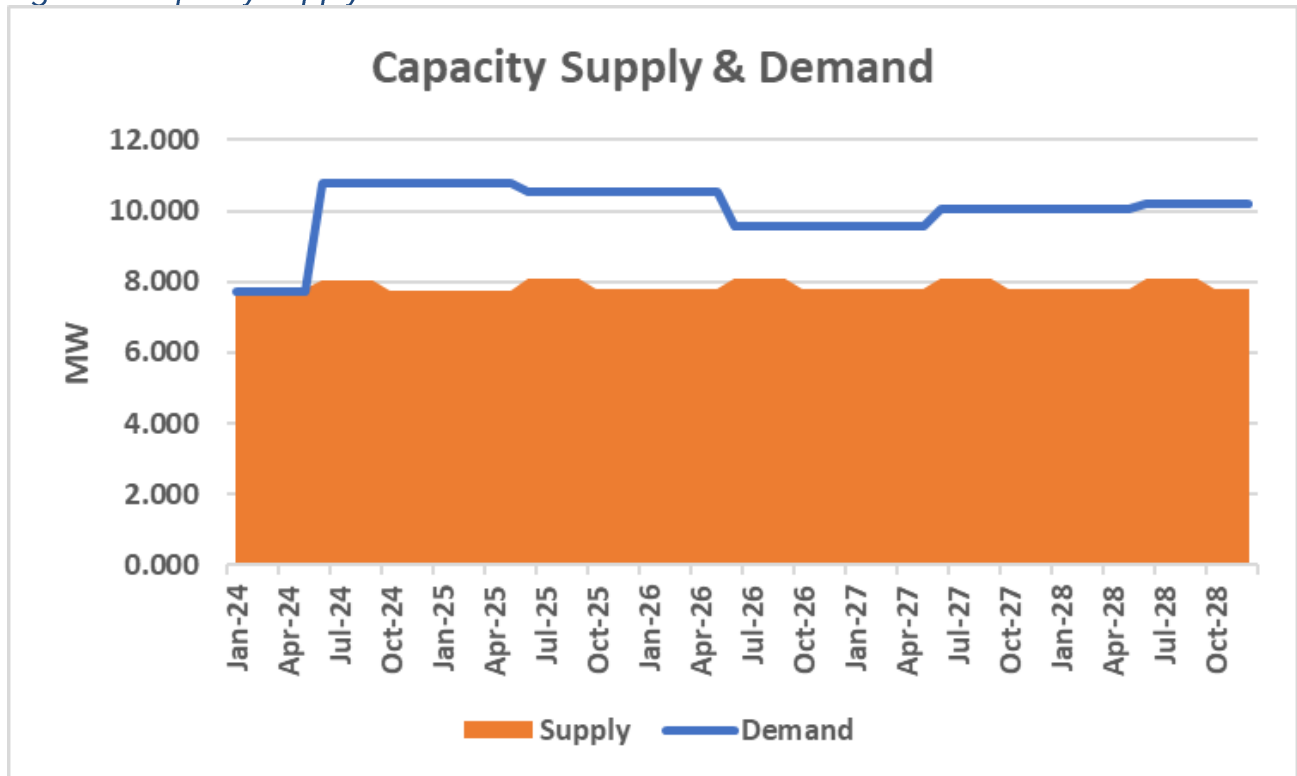
Figure 1: Energy Supply & Demand



Capacity

Figure 2 shows the capacity supply and demand balance for the first part of 2024. After that there is a deficit of about 25% which will be fulfilled in ISO New England’s Forward Capacity Market. Capacity prices bottomed out in 2023 and have increased minimally through the majority of the forecast period.

Figure 2: Capacity Supply and Demand



Renewable Energy Credits

Figure 3 and

Tier II

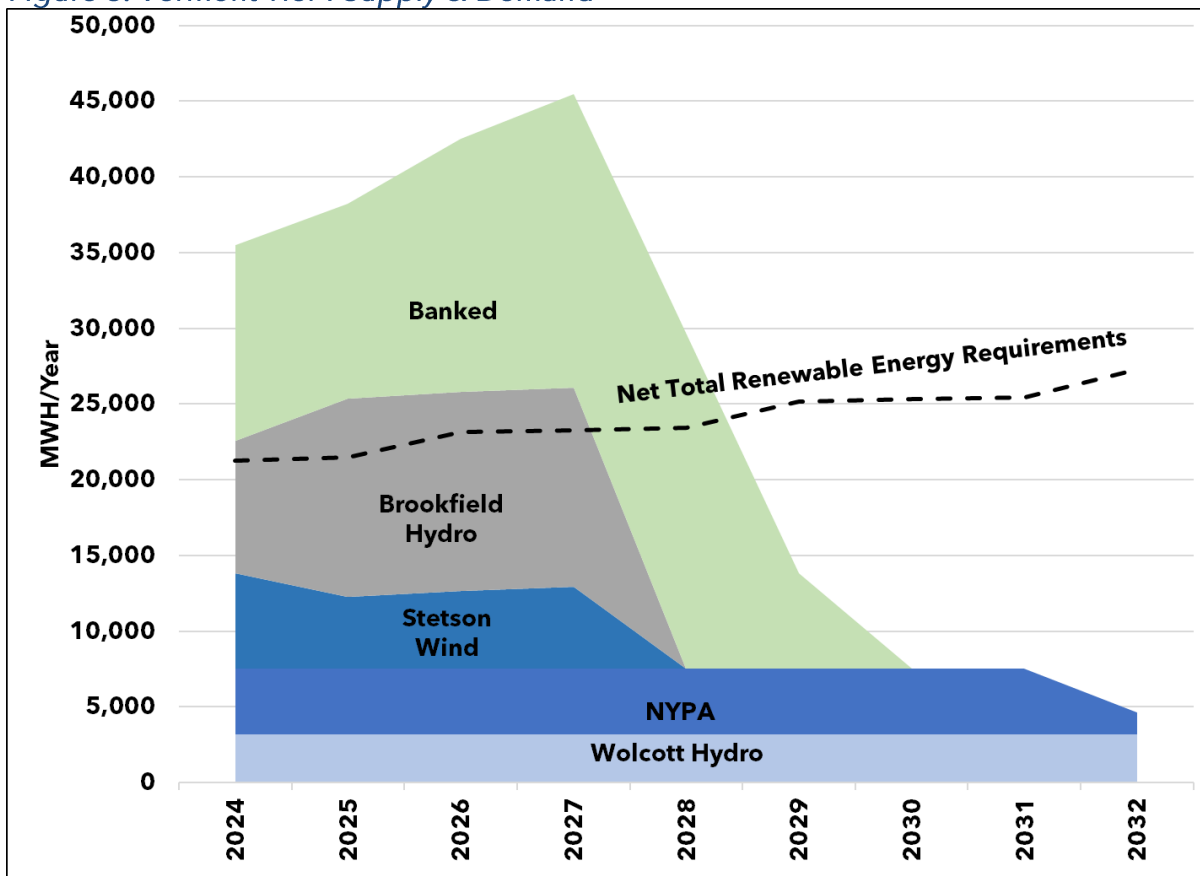
HED anticipates a surplus of Tier II RECs through 2032. This is due to a high level of uptake in the net metering program and the Billings Road Solar project. Surplus RECs may be allocated to HED’s Tier III requirements and/or sold to reduce HED’s cost of service.

Figure 4 illustrate HED’s need for RECs under Vermont’s Renewable Energy Standard (RES).

Tier I

There is expected to be a large excess of RECs from 2024 through 2028 after the Stetson and Brookfield contracts expire and all banked RECs are utilized. After that point the deficit ranges from about 11,000 to about 22,600. This will be filled either with a bundled energy and REC purchase or a REC only purchase.

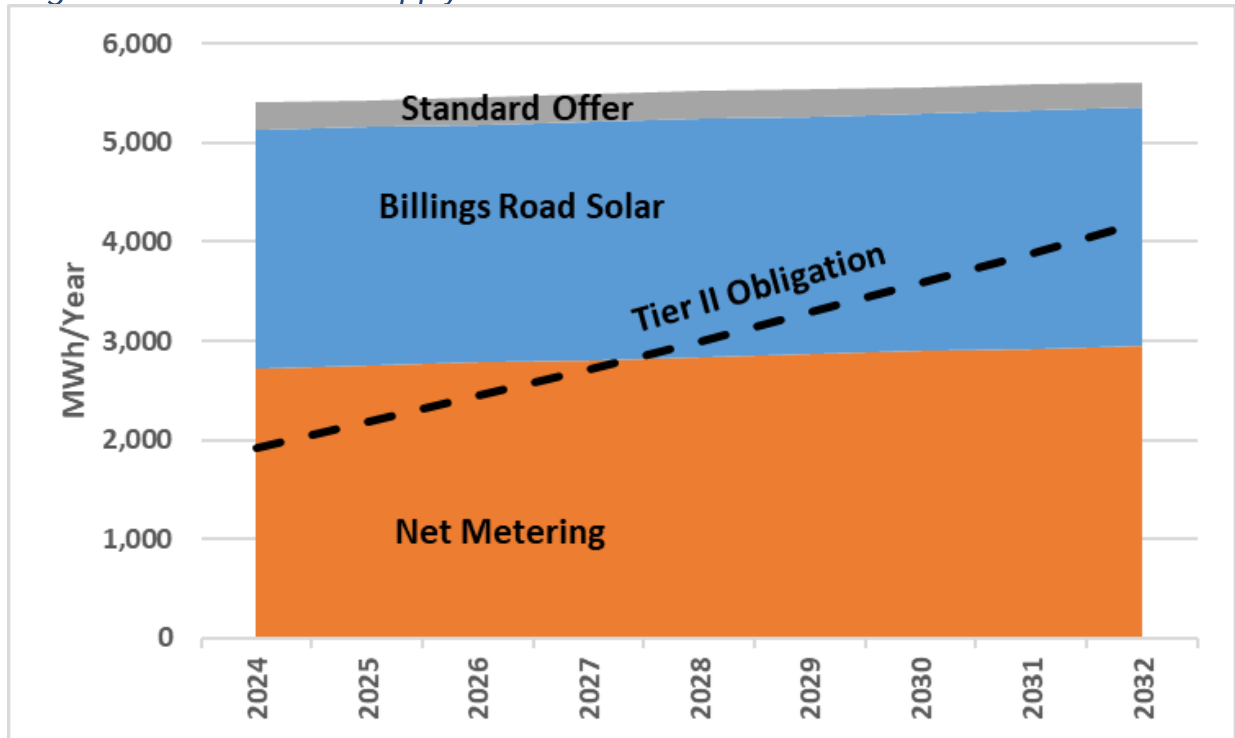
Figure 3: Vermont Tier I Supply & Demand



Tier II

HED anticipates a surplus of Tier II RECs through 2032. This is due to a high level of uptake in the net metering program and the Billings Road Solar project. Surplus RECs may be allocated to HED's Tier III requirements and/or sold to reduce HED's cost of service.

Figure 4: Vermont Tier II Supply & Demand



IV. Anticipated Transactions & Acquisition Strategy

VPPSA anticipates that HED may enter into one or more of the transactions that are listed in Table 4.

Table 4: Anticipated Hedging Transactions

| Product | Action | Term | Quantity | Anticipated Price Range | Transaction Anticipated |
|------------------------|------------------|-------------|-----------------|-------------------------|-------------------------|
| 7x24 Energy | Purchase or Sale | 1 month | 0-0.8 MW | \$26-\$95 /MWH | Monthly / Seasonally |
| On / Off Peak Energy | Purchase | 1-60 months | 0-1.5 MW | \$25-\$100 /MWH | Monthly / Seasonally |
| Long-Term Bundled PPAs | Purchase | 5+ years | 0-3.0 MW | \$30-\$70 /MWH | None anticipated. |
| Capacity | Purchase | 5+ years | 0 MW | \$2-\$5 /kW-month | None anticipated. |
| VT Tier I RECs | Purchase | 1-5 years | 18,000 MWH/Year | \$4 - \$10 /MWH | 2028 |
| VT Tier II RECs | Sale | 1-5 years | 2,000 MWH/Year | \$35 - \$45 /MWH | 2024 |

Energy Acquisition Strategy

7x24 Energy

VPPSA's Power Supply Authorities Policy requires that energy supplies be within +/-5% of the forecasted demand in each month of the year. This is known as the hedge ratio, and it is simply the ratio of the forecasted supply to the forecasted demand. Any imbalances between supply and demand are hedged to these levels before the operating month begins. In practice, changes in weather, generator availability and forecast error sometimes combine to push the actual percentage outside of the +/-5% threshold.

At least seasonally (four times a year), VPPSA uses a 7x24 energy product to refine the energy hedge ratio for HED. The following three-step process is used to balance supply and demand on a monthly basis within the current budget (calendar) year.

1. Update Budget Forecast

- a. The budgeted volumes (MWH) are updated to reflect known changes to demand and supply including unit availability, fuel supply, and hydrological conditions.

2. Hydroelectric Adjustment

- a. Supply is reduced by one standard deviation from the long-term average in order to avoid making sales that could end up being unhedged by supply in the event of a dryer-than-normal month.

3. Execute Purchases or Sales

- a. **Internal Transactions:** VPPSA seeks first to make internal transactions between its members to balance supply and demand. The transactions are designed to result in a hedge ratio that falls within the +/-5% range that is required by VPPSA's Power Supply Authorities Policy.
- b. **External Transactions:** In the event that internal transactions cannot bring HED into the +/-5% range, external transactions are placed with power marketers, either directly or through a broker.
- c. **Price:** For Internal Transactions, the price of the transaction is set by an average of the bid-ask spread as reported by brokers on the date of the transaction. For External Transactions, the price is set through a negotiation with the counterparty.

On / Off Peak Energy

Known within VPPSA as “planned purchases”, these transactions are almost always purchases. They typically take place no more than once a year, usually carry a 1-5 year term, and if possible, are executed at a time when market prices are at or below budgeted levels.

These purchases are designed to fit the on and off-peak energy needs in each month of the year as precisely as possible. As a result, they minimize the need for monthly 7x24 hedging transactions under VPPSA’s Power Supply Authorities Policy.

The solicitation method is an informal Request for Proposals (RFP), and follows a three-step process.

1. **Pre-Approval Term Sheet:** First, the proposed purchase volumes and anticipated prices are documented in a standardized term sheet. This document is distributed to each VPPSA member for their pre-approval, and it defines their share of the total purchase.
2. **Issue RFP:** Once all of the pre-approvals are received, the term sheet is distributed to three or more power marketers, who are asked to make their best offer by a deadline, typically within 5 business days.
3. **Evaluate & Execute:** When all of the bids are received, VPPSA evaluates them to determine the lowest cost bid, and executes the purchase with that counterparty. Then the purchase is allocated to each VPPSA member according to their pre-approved term sheet, and the data is entered into VPPSA’s database for scheduling, delivery and invoice tracking.

Long-Term Bundled PPAs

VPPSA evaluates long-term Purchased Power Agreements (PPAs) for bundled energy, capacity, renewable energy credits, and/or ancillary products on an ongoing basis. There is currently no plan for a long-term PPA, although additional energy contracts will be required once the Brookfield and Stetson contracts expire at the end of 2027. Because long-term PPAs are subject to PUC approval, the acquisition strategy is simply to negotiate the best terms and to make contract execution contingent on PUC approval.

Capacity Acquisition Strategy

Capacity is seldom acquired as a stand-alone product, and because market prices are fixed by the Forward Capacity Market three years in advance of the operating year, there is little opportunity to make short-term (< 5 year) capacity purchases. ISO New England is on track to drastically change the capacity market to a prompt/seasonal market which is likely to alter HED's capacity procurement strategy once the new market details are known. Beyond purchasing capacity, there is short-term opportunity on the demand side. For example, VPPSA forecasts monthly and annual coincident peak loads, and communicates the forecast of the peak day and hour to its members. As a result, all available demand-side actions are taken to reduce capacity requirements. This presently includes maximizing behind-the-meter generation such as load-reducing hydro, demand response using VPPSA's contract with Virtual Peaker³, and exploring battery storage for peak shaving.

REC Acquisition Strategy

VPPSA acquires RECs on behalf HED and its other members during the quarterly trading periods that are defined in the NEPOOL Generator Information System (GIS)⁴. The acquisition strategy has three parts.

1. First, VPPSA completes an analysis of Tier I and Tier II requirements before or during the annual REC trading period. Because REC banking is limited to three years, the analysis never calls for purchasing more RECs than can be used during that time frame.
2. Second, broker quotes are compared to the Alternative Compliance Payment and budgeted REC prices to decide when to purchase RECs.
3. VPPSA may purchase smaller volumes of Tier I RECs toward the close of quarter 4 if prices are lower than budget.

³ More information on Virtual Peaker can be found on their website at <https://www.virtual-peaker.com/>.

⁴ <https://www.nepoolgis.com/>

Generation and Transmission Facility Transactions

Generation

VPPSA continues to work with Encore Renewables to develop Tier II qualifying solar projects within its members service territories. Although HED expects to have a surplus of Tier II RECs for the coming five years, VPPSA is monitoring legislative changes that could double the Tier II requirements. In this event, HED may seek to participate in another solar project through VPPSA and Encore Renewables.

Transmission

HED does not anticipate any transmission facility transactions in the coming year.

Waiver Request

In accordance with Rule 5.204, HED requests a waiver of the notification for short-term transactions that will be subject to after-the-fact reporting, pursuant to Rule 5.206(A). These transactions could be up to five years in nature and are designed to either hedge HED's short-term exposure or maximize short-term value of existing resources. HED anticipates seeking individual waivers of any longer-term purchases as otherwise required by Rule 5.200, if necessary.